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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
JOHNSTON, PHILLIP A	
ART UNIT	**PAPER NUMBER**
2881	

DATE MAILED: 09/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Applicati n N .	Applicant(s)
	10/082,288	SATO ET AL.
	Examiner	Art Unit
	Phillip A Johnston	2881

-- The MAILING DATE of this c mmunication appears on the cover sheet with the c rrespondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-23 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-23 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

D tail d Acti n

Specification

1. The disclosure is objected to because of the following informalities: Page 6, line 2, "correction astigmatism" should be "correction of astigmatism"; page 8, line 10,"aligner 1" should be "aligner 51"; page 17, line 11, "exciting" should be "existing"; page 18, line 8, "chance" should be "choice"; page 19, line 11, "measure" should be "measured"; page 20, line 2, "in spite that" should be "in spite of the fact that"; and line 5, "image" should be "images"; page 21, line 26, "then " should be "the"; page 25, line 4, "change" should be "changes".

Appropriate correction is required.

Claims Rejection – 35 U.S.C. 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 recites the limitations "said objective lens" in line 8; "said alignment deflector" in line 9; and "said charged particle beam optical system" in line 19. There is insufficient antecedent basis for these limitations in the claim.

Claims Rejection – 35 U.S.C. 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-23 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,333,510 to Watanabe et al.

Regarding Claims 1 and 3-7, Watanabe discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. The electron beam apparatus 100 is composed of an electron beam column for irradiating electron beams on an inspected object (sample) 106, an electron beam source 101 is used for emitting electron beams, a deflection element 102 for deflecting electron beams emitted from the electron beam source 101 in a two-dimensional fashion, and an objective lens 103 which is controlled so as to focus the electron beam on the sample 106. Specifically, the electron beam emitted from the electron beam source 101 is passed through the deflection element 102 and the objective lens 103 and focused on the sample 106. It is implied here that deflection element 102 is equivalent to the aligner, (as recited in Claims 4 and 5). The sample 106

rests on an XY stage 105, and the position thereof, is measured by a laser length measuring system 107. Further, secondary electrons emitted from the sample 106, are detected by a secondary electron detector 104, and the detected secondary electron signal is converted by an A/D converter 122 into an SEM image. The SEM image thus converted is processed by image processing unit 124. See Column 14, line 62-67, and Column 15, line 1-16. As the stage moves, the image processing circuit 124 compares corresponding images or repetitive patterns by comparing an electron beam image delayed by the image memory and an image directly inputted from the A/D converter 124. The images, a detection image (first two-dimensional image) in which gradation values of coordinates (x, y) aligned at the pixel unit are f1(x, y) and a compared image (second two-dimensional image) in which gradation values of coordinates (x, y) are g1(x, y) are compared with each other in image output unit 140, where image correction circuit 40, aligns the two images and calculates the "matching degree" which corrects dark level, source fluctuation and shading. See Column 18, line 34-39; Column 19, line 36-42 and Column 24, line 15-31. After shading correction, the image 80 is processed via a Gaussian filter, resulting in the digital image signal 82 being improved. See Column 23, line 18-32. Watanabe teaches that image distortion correction, caused by the deflection of the electron optical system is accomplished by using the correction standard pattern 130. As the stage 105 moves the correction sample 130, the optical unit calculates the height of the surface using height calculating unit 200b. At the same time, the beam scans produce SEM images, which are obtained and processed to calculate the visibility Si of each image. The corresponding focus control signals Ii are

then set in the entirety control unit 120 for each image until the visibility Si becomes a maxim. Thereby a correction curve is created by image processing unit 124, and stores the image distortion correction parameter thus obtained in the memory 142 (as recited in Claim 4). It should be noted that the processes of (1) continuous movement of the stage, (2) beam scanning, (3) optical height detection, (4) focus control and/or deflection direction and width correction, and (5) secondary electron image acquisition are all executed simultaneously. In this way, the acquired SEM image is kept focused and distortion-corrected while the image is being acquired continuously and speedily. See Column 47, line 15-65, and Column 48, line 1-4. It is implied herein that the entirety control unit 120 of Watanabe, contains a convergence condition for each deflection condition and therefore the continuous dynamic correction of the electron optical system (consisting of both deflection and objective lens controls) includes and is equivalent to the limitation of "changing a convergence condition of said objective lens to two states when a deflection condition of said alignment deflector is rendered to a first state detecting a first deviation between first and second sample images obtained when the deflection condition of said alignment deflector is rendered to the first state" as recited in Claims 1 and 3. It is also implied, that creation of the image distortion correction curve in this manner is equivalent to the limitation, "calculating an unknown changing depending on an operation condition of said charged particle beam optical system by applying information of the first and second deviations to an equation finding the deviation of the sample image relative to a change of an alignment condition and obtaining the alignment condition based on the calculated unknown and a condition in which an

image deviation becomes small when the convergence condition of the objective lens is changed to the two condition" as recited in Claims 1 and 3. It is also implied that the calculated image distortion correction curve is equivalent to "calculating a drift amount based on the deviation between both sample images", as recited in Claim 7. Watanabe further teaches that, during actual inspection of sample 106, the entirety control unit 120 reads out the correction parameter from the memory 142, loads a height detection apparatus correction parameter to the height calculating unit 200b, loads a height-focus control signal correction parameter to the focus control apparatus 109, and loads an image distortion correction parameter such as an image magnification correction to the deflection control apparatus 108. Then as the stage 105 moves sample 106, SEM images are obtained, and corrected continuously by image processing unit 124. See Column 48, line 39-67 and Column 49, line 1-9. It is implied herein that continuously obtaining, and performing image comparisons, while performing focus and deflection control is equivalent to the limitation of "detecting a second deviation between third and fourth sample images obtained when the deflection condition of said alignment deflector is rendered to the second state, and other convergence conditions" as recited in Claims 1, 3, 4 and 6.

Regarding Claims 2 and 8-10, Watanabe as applied above to Claims 1-6 discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. Watanabe also teaches

that while using the apparatus and method during actual image inspection, the entirety control unit 120, concurrently issues a command to the deflection control apparatus (deflection signal generating apparatus) 108, and the deflection control apparatus 108 drives the beam deflector 102 to scan electron beams in the direction perpendicular to the movement direction of 125. Simultaneously, the deflection control apparatus 108 receives the height detection value 190 obtained from the height calculating unit 200b and corrects a deflection direction and a deflection width. See Column 17, Line 54-65. It is well known in the art that "image distortion" is synonymous with astigmatism, as a result, the Watanabe method and apparatus for correcting image distortion as applied above in Claims 1 and 3-7, is equivalent to the astigmatism correction method and apparatus limitations, as recited in Claims 2 and 8-10.

Regarding Claim 11, Watanabe as applied above to Claims 1-10 discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. Watanabe further discloses a device for image alignment based on pixel unit position alignment unit 42 of image processing unit 124 which displaces the position of comparison image, for example, in such a manner that the position displacement amount of the comparison image g0(x, y) relative to the above-mentioned detection image f0(x, y) falls in a range of from 0 to 1 pixel, in other words, the position at which a "matching degree" between f0(x, y) and g0(x, y) becomes maximum falls within a range of from 0 to 1 pixel. As

a consequence, as shown in FIGS. 6(a) and 6(b), for example, the detection image f0(x, y) and the comparison image g0(x, y) are aligned with an alignment accuracy of less than one pixel. A square portion shown by dotted lines in FIG. 6 denotes a pixel. This pixel is a unit detected by the electron detector 35, sampled by the A/D converter 39 (122), and converted into a digital value (gradation value: light and shade value). That is, the pixel unit denotes a minimum unit detected by the electron detector 35. After the image "matching degree" is calculated by image processing unit 124, the pixel unit position alignment unit 42 outputs the images at specified displacement coordinates. See Column 24, line 15-32. It is implied herein that while the entirety control unit 120 is continuously and automatically calculating deflector alignment conditions, as described above, it is equipped with the means for deciding if conditions are suitable for performing the calculations from sample image information and whether to generate alarms relative to its suitability for the calculation, as recited in Claim 11.

Regarding Claims 12 and 13, Watanabe as applied above to Claims 1-11, discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. Watanabe further teaches, the length measurement of sample 106 is automatically executed by the image processing unit 124, which measures a line width or a hole diameter of a micro-circuit pattern. See Column 14, Line 25-31. It is implied herein, that calculating the image "matching degree" is equivalent to "quantizing an image" as recited in Claims 12 and 13.

Regarding Claim 14, Watanabe as applied above to Claims 1-12, discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. In addition, a method of calculating image "matching degree", equivalent to "quantizing" is described therein. Watanabe also teaches the use of threshold values for image comparison, which are the upper and lower allowance values of image matching. A threshold value computing circuit (allowance range computing unit) 48 is adapted to calculate by using the image signals f1, g1 from the delay circuits 46, 47 and the positional displacement amounts of less than the pixel obtained from the less than pixel positional displacement detection unit, two threshold values (allowance values indicative of allowance ranges) thH(x, y) and thL(x, y) which are predetermined values, used by the defect deciding circuit (defect judgment unit) 50 to determine in response to the value of the difference image (distance image) sub(x, y) obtained from the difference image extracting circuit (difference extracting circuit: distance extracting unit) 49 whether or not the inspected object is the nominated defect. See Column 26, line 33-45.

Regarding Claims 15-20, Watanabe as applied above to Claims 1-14, discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. Watanabe teaches that

a plurality of calculation methods (as recited in Claim 16) are utilized by entirety unit 120 to control beam deflection. The methods include but are not limited to; height calculation, image matching degree calculation, image correction calculation, and image difference calculation. See Column 15, line 34; Column 25, line 48; Column 26, line 31. In addition, it was also shown above that these calculating methods are used in the processes of (1) continuous movement of the stage, (2) beam scanning, (3) optical height detection, (4) focus control and/or deflection direction and width correction, and (5) secondary electron image acquisition which are executed simultaneously by entirety unit 120, so that the acquired SEM images are kept focused and distortion-corrected while the image is being acquired continuously and speedily. It is implied herein that predetermined values, representative of optical device conditions, are utilized by entirety unit 120 as an integral part of focus control and distortion correction processing. Regarding Claims 21-23, Watanabe as applied above to Claims 1-20, discloses an apparatus and method for reducing the deflection and aberration induced image distortion encountered in an electron beam inspection apparatus, wherein SEM images are continuously compared, while controlling both deflection and the objective lens with sample height information from a surface height detection unit. Watanabe further teaches that the height detection apparatus utilizes the optical shift of a slit image to define the relative measure of the height of a sample surface. The displacement of the slit image is measured by using its center of gravity. According to this method, such displacement is converted into a height on the basis of the position of the edge of the slit image. Initially, the peak of each slit and the positions of troughs on the respective

sides are calculated and a proper threshold value is calculated from the amplitude. Then two points are set across this threshold value for x. Then, x coordinates of a point at which the line connecting the above two points and threshold value for y, are also set. This operation is effected on each of left and right inclined portions of the slit, the positions of the crossing points between the threshold values and this line are calculated, and then a middle point (center of gravity) is determined as the position of the slit. See Column 44, line 53-65, and Column 45, line 1-2

Conclusion

5. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (703) 305-7022. The examiner can normally be reached on Monday-Friday from 8:00 am to 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (703) 308-4116. The fax phone numbers are (703) 308-2864 and (703) 308-7721.

PJ
August 29, 2002

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